UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
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H. H. BENNETT, CHIEF

A COMPARISON OF THE COLORADO AND TYPE-F ARTIFICIAL RAINFALL APPLICATORS

Hastings, Nebraska

Office of Research
August 1940

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MEMORANDUM for Project Supervisors

Enclosed is copy of a paper by L. L. Kelly of the Hastings Project, entitled "A Comparison of the Colorado and the Type-F Artificial Rainfall Applicators." It compares infiltration obtained with the Colorado type oscillating sprinkler with that obtained with the Type-F sprinkler.

The principal result of these tests is to show definitely that the rate of infiltration at a given location obtained by a sprinkler test is dependent on the type of apparatus used.

L. L. Harrold
for H. R. Leach
Work Project Leader

Enclosure.

Approved by

C E Ramser
Chief, Hydrologic Division

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by

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A COMPARISON OF THE COLORADO AND THE TYPE-F ARTIFICIAL RAINFALL APPLICATORS

by I. L. Kelly

INTRODUCTION

In connection with investigations of run-off and erosion at the Central Great Plains Experimental Watershed at Hastings, Nebraska, a study was made to determine the differences in the infiltration capacity of the soil when subjected to sprays produced by two different types of artificial rainfall apparatus or sprinklers. This comparison was required as a basis for relating the results of past work at the project to measurements in the future using a different apparatus. Since the results of this study will also be of considerable value in guiding other studies with artificial rainfall, they are briefly presented herein.

The two types of applicators compared were the Colorado type, developed by the Soil Conservation Service in Colorado, and the type-F applicator, developed by the Soil Conservation Service at the National Hydraulic Laboratory in Washington.

APPARATUS

Plot Size and Boundaries

Both the Colorado and the type-F simulators were adjusted to sprinkle a plot 6 ft. wide and 24 ft. long. The boundaries of the plots were made of 10-inch boards with their upper edges

Figure 1. The two applicators, the Colorado on the left and the type-F on the right, were set on adjacent plots. The 1000-gallon water supply tank can be seen in the background.

cut to a sharp edge. In placing the boundary boards, a trench 6 in. deep, with a vertical face next to the plot, was dug around the plot, the board placed in the trench next to the vertical face, and damp soil packed in next to the board. This, with the use of tar in all joints, produced a water-tight boundary to a depth of 6 in. The boundary boards may be seen in Fig. 4.

Description of the Colorado Applicator

The Colorado applicator consists essentially of an overhead supply pipe 6 ft. above the ground provided with fan-shaped nozzles as shown in Fig. 2. When this pipe was oscillated through an arc of about 60 degrees the entire plot was sprinkled. The nozzles were swung far enough so that water was thrown slightly beyond the boundaries of the plot where it was caught in metal gutters and measured. Thus no wetting beyond the boundaries of the plot occurred. The rain pattern, because of the oscillation, consisted of a series of parallel paths moving across the plot. Intensities were varied by using different sets of nozzles, the nozzle of each set containing a different number of holes. The pressure on the overhead supply pipe was from 12 to 24 in. of water, the pressure being varied slightly to change the intensity. A constant pressure was maintained during a given test by the use of a float-operated constant level tank. Shelter from wind was provided by a canvas tent which completely

Figure 2. The Colorado applicator. The tank mounted on top of the framework is the float-controlled constant head tank. The nozzles are shown inverted. In this position initial adjustment of the valves is made, allowing the water to drain out of the hose at the lower end of the pipe. Final adjustment is made after the sprinkler is started. Pressures are determined by the manometers mounted at the left end and midpoint of the header pipe.

enclosed the plot when necessary. Water to the constant head tank was forced by compressed air from a 750-gallon truck tank and a 1000-gallon trailer tank.

Description of the type-F Applicator

On this applicator, header pipes were supported on each side of the plot 1.75 ft. away from the plot and 2.00 ft. above the ground surface. The pipes supplied water to 24 specially designed sprinkler nozzles, 12 on each side of the plot. The nozzles operated under a pressure of 35 lbs. per sq. in., and threw the water up about 7.5 ft. and onto the plot. Each nozzle was constructed in such a way that only one stream of water was produced and so that this stream was given a twitching motion which broke the stream into drops and spread them over a small section of the plot. Metal hoods, actuated by levers, that prevented the water from going on the plot were provided for the nozzles, and by means of four valves and four gages the apparatus was adjusted while the plot was maintained in a dry condition. The hoods were then thrown back and the application began with everything in complete adjustment. The nozzles distributed water over the entire plot and for several feet beyond the borders of the plot. This tended to offset one disadvantage of the Colorado applicator which lost water by lateral movement from the plot area to the unwatered soil adjoining the plot boundary.

This applicator normally produced an intensity of approximately 3.5 in. per hr. with all nozzles operating, but by keeping

the hoods over alternate nozzles an intensity of half this amount could be obtained. Water was supplied by the same trailer and truck tanks as used for the Colorado applicator but a high pressure centrifugal pump, operated by the truck motor, was used to produce the required pressure. Canvas windbreaks were used for wind protection.

METHODS OF MAKING MEASUREMENTS

The application intensity of the Colorado equipment was measured by a water meter which was read every 5 min. From the amounts of water determined by these readings were subtracted the amounts caught in the gutters on the outside of the plot borders as mentioned above. The average intensities for the 5-minute periods were then calculated.

Since the type-F applicator threw water beyond the confines of the plot, it was not possible to use a water meter for the intensity determination. During the run every effort was made to maintain uniform pressures on the nozzles. After the test was over, a water-proof tarpaulin was laid on the plot and all the water regularly falling on the plot was caught and measured with the run-off measuring equipment at the lower end of the plot. The intensity test was run for 5 or 10 minutes. The intensity was calculated for this period and was then assumed to be the intensity used for the entire period of the test.

The amount of run-off from each of the applicators was

measured with a two-compartment metal tank calibrated in 0.001 in. of run-off from the 6 x 24 ft. plot area (fig. 3). A stop watch was used to measure the time. Although the figures determined by this method are not instantaneous rates but average rates for the time intervals, it is felt that, because of the short time intervals between readings, these average rates may be used without introducing appreciable error.

Soil moisture samples to the depth of penetration of the previous application were taken before each test.

DESCRIPTION OF PLOTS AND VEGETATION

A small area on a native meadow was chosen for the plots so that the soils, slopes and cover would be as nearly alike for each plot as possible. The slopes for the plots were:

Plot		Slope Percent	Plot		Slope Percent
1	-	6.0	5	-	5.3
2	-	5.8	6	-	5.4
3	-	5.8	7	-	4.6
4	-	5.7	8	-	4.5

The grass on plots 1 to 6, inclusive, was clipped to a uniform height of 3 in. and the clipped portion removed without disturbing the debris and litter on the soil surface. The cover on the meadow is characterized by the many bare spaces where accumulation of litter has been prevented by prevailing high winds and drought. Typical distribution of the vegetation, consisting mostly of blue gramma and sand drop seed, is shown by

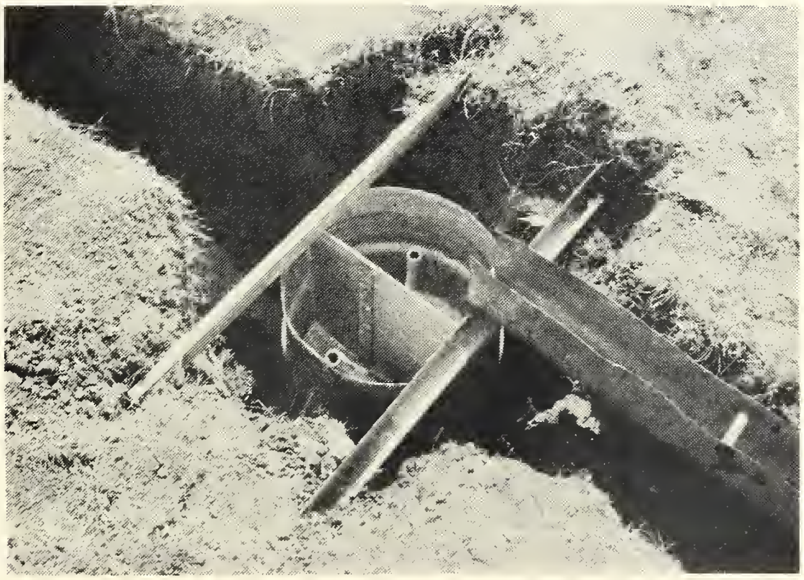

Figure 3. The run-off measuring tank. Each compartment was calibrated in 0.001 in. of run-off from the 6 x 24 ft. plot. When one compartment became full the trough was switched over to the other compartment, the water in the first compartment then was released through a hole in the bottom. A stop watch was used for measuring the time for each compartment to fill and from this the rate of run-off was determined.

the photograph, Fig. 4. An ecological survey was made on several small watersheds and plots in the same meadow and from these data the basal cover on these plots is estimated at 35 percent.

On plots 7 and 8 all grasses and debris were removed. The plots were leveled, spaded to a uniform depth of 4 in., and cultivated with a hoe and rake so that all clods larger than about 1/2 in. were broken. Plot 8 contained more fine dust-like material than plot 7. The plots were then raked level so that no depressions were left for water storage. No uneven settling occurred to cause depressions after the tests began.

DESCRIPTION OF SOIL

The soil in all of the plots was Hastings Silt Loam. The dark brown surface soil was 10 to 14 in. deep. This graded gradually to the brownish yellow silt loam below. A structureless mulch, somewhat less than an inch thick, occurred at the surface of all the uncultivated plots. Below this, the soil was granular in structure and when dry, as it was at the time these tests were commenced, was characterized by large vertical cracks 1/8 in. or more in width. These cracks closed when the soil became wet.

At the start of the tests all plots were extremely dry, the soil moisture content being reduced, in the first 2 ft., to approximately 10 percent.

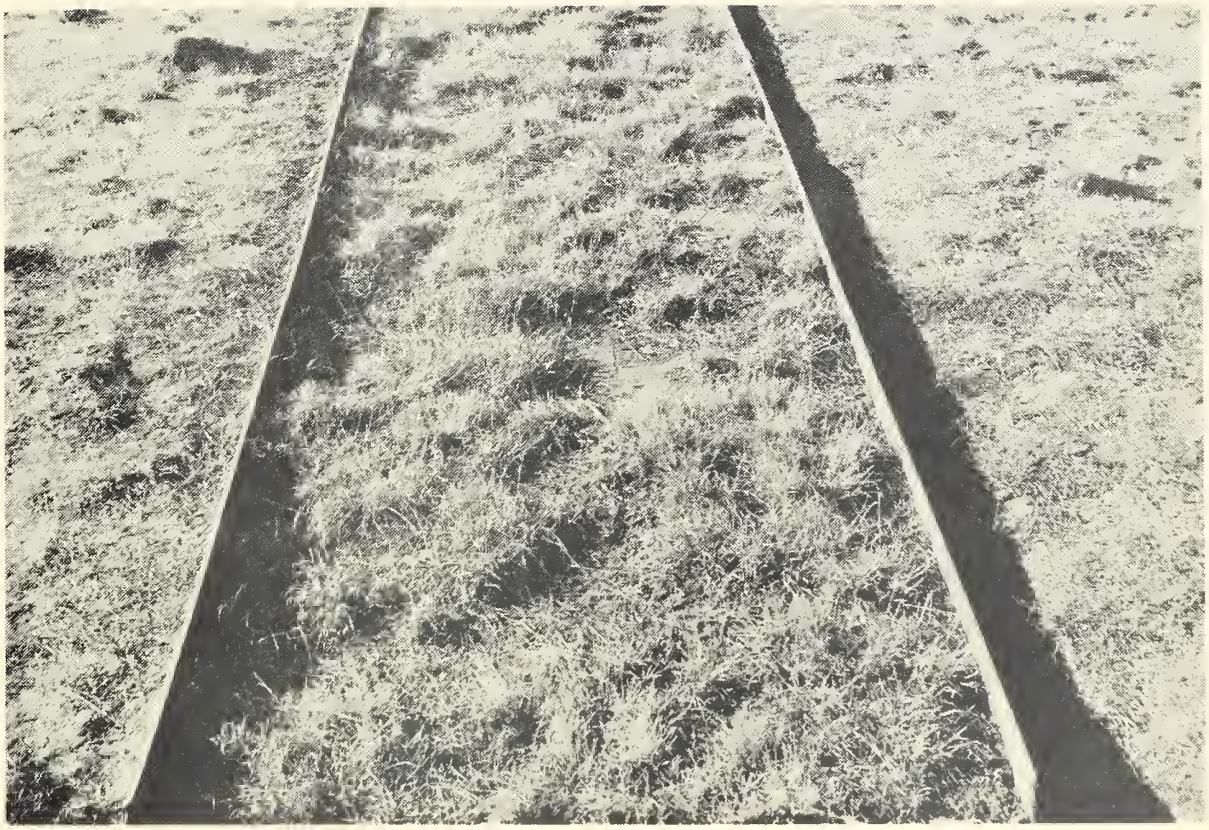

Figure 4. This photograph of Plot 2 shows typical vegetal cover of the plots. Many bare spots occur. Before the test the grass was clipped to about 3 in. in height. At the time of the tests in October and November 1939 the grass was dry and brittle, but upon wetting it straightened up and, as shown in the picture, appears higher than the 3 in.

EFFECT OF DIFFERENT APPLICATORS ON INFILTRATION

Infiltration as used in this paper is the difference between rainfall and run-off and includes interception, surface depression storage, surface detention, and absorption into the soil or infiltration proper. As the application of rainfall is prolonged the difference gradually approaches the infiltration.

Table 1 is included to show the general plan under which the plots were run and to give a summary of the data for each test. However, special mention should be made of several of the facts brought out by the investigation.

1. The first two tests on plots 1 to 6 inclusive were as nearly alike as it was possible to make them. Plots 1, 3, and 5 received a 90-minute application from the Colorado applicator and plots 2, 4, and 6 a similar application from the type-F applicator. These are the dry runs. The second tests are the 60-minute wet runs made 24 hr. later on the same plots with the same applicator as used in the first or dry run. A comparison of the average infiltration rates for the last 15 min. (during which time the infiltration rate was sensibly constant) for each plot follows:

Table 1.- Infiltration as determined by the use of the Colorado (C) and the type-F applicators. Tests made on native sod land.

Date 1939	Run No.	Plot No.	Test No.	Type of applicator	Condition of plot before test	Duration of test	Application intensity	Total application	Total run-off	Total absorption	"f" 1/
						Min.	In/hr	In.	In.	In.	In/hr
10/24	15	1	1	C	Dry	90	4.42	6.63	1.86	4.77	3.10
10/24	16	2	1	F	Dry	90	3.24	4.86	1.44	3.42	2.24
10/25	17	1	2	C	Wet	60	4.40	4.40	2.16	2.24	1.77
10/25	18	2	2	F	Wet	60	3.20	3.20	1.49	1.71	1.47
		Totals of Colorado plots				150		11.03	4.02	7.01	
		Totals of F plots				150		8.06	2.93	5.13	
10/26	19	3	1	C	Dry	90	3.34	5.01	1.06	3.95	2.54
10/26	20	4	1	F	Dry	90	3.19	4.78	1.63	3.15	2.07
10/27	21	3	2	C	Wet	60	3.32	3.32	1.23	2.09	1.86
10/27	22	4	2	F	Wet	60	3.29	3.29	1.58	1.71	1.49
		Totals of Colorado plots				150		8.33	2.29	6.04	
		Totals of F plots				150		8.07	3.21	4.86	
11/6	35	1	3	F	Moist	90	3.44	5.16	2.31	2.85	1.34
11/6	36	2	3	C	Moist	90	2.84	4.26	1.39	2.87	1.39
11/7	37	1	4	F	Wet	60	3.26	3.26	2.12	1.14	.62
11/7	38	2	4	C	Wet	60	2.85	2.85	1.56	1.29	.70
		Totals of Colorado plots				150		7.11	2.95	4.16	
		Totals of F plots				150		8.42	4.43	3.99	
11/8	39	3	3	F	Moist	90	3.12	4.68	1.88	2.80	1.65
11/8	40	4	3	C	Moist	90	2.83	4.24	1.19	3.05	1.58
11/9	41	3	4	F	Wet	60	3.18	3.18	1.87	1.31	.88
11/9	42	4	4	C	Wet	60	2.74	2.74	1.34	1.40	.74
		Totals of Colorado plots				150		6.98	2.53	4.45	
		Totals of F plots				150		7.86	3.75	4.11	
10/30	23	5	1	C	Dry	90	2.88	4.32	1.06	3.26	2.06
10/30	24	6	1	F	Dry	90	3.48	5.22	2.46	2.76	1.64
10/31	25	5	2	C	Wet	60	2.91	2.91	.81	2.10	1.94
10/31	26	6	2	F	Wet	60	3.66	3.66	1.83	1.83	1.34
11/1	27	6	3	C	Wet	50	2.91	2.42	1.23	1.19	1.17
11/1	28	5	3	F	Wet	50	3.16	2.63	1.28	1.35	1.16
11/2	29	5	4	C	Wet	95	1.51	2.38	.57	1.81	.93
11/2	30	6	4	F	Wet	60	1.42	1.42	.67	.75	.57
11/3	32	6	5	C	Wet	40	2.79	1.86	.97	.89	.94
11/3	31	5	5	F	Wet	40	3.32	2.22	1.46	.76	.66
11/4	33	5	6	C	Wet	40	2.75	1.83	.97	.86	.84
11/4	34	6	6	F	Wet	40	3.42	2.28	1.45	.83	.78
		Totals of Colorado plots				375		15.72	5.61	10.11	
		Totals of F plots				340		17.43	9.15	8.28	
11/13	43	7	1	C	Dry	270	2.74	12.33	1.79	10.54	1.28
11/14	44	8	1	F	Dry	180	3.40	10.20	4.62	5.58	1.15
11/15	45	7	2	C	Wet	75	2.86	3.58	1.83	1.75	.76
11/15	46	8	2	F	Wet	75	3.49	4.36	2.45	1.91	.88
11/16	48	8	3	C	Wet	45	2.87	2.15	1.40	.75	.75
11/16	47	7	3	F	Wet	45	3.31	2.49	1.71	.78	.63
11/17	49	7	4	C	Wet	45	2.85	2.14	1.44	.70	.68
11/17	50	8	4	F	Wet	45	3.48	2.61	2.11	.50	.52
11/18	52	8	5	C	Wet	30	2.82	1.41	.85	.56	.80
11/18	51	7	5	F	Wet	30	3.68	1.84	1.43	.41	.52
11/19	53	7	6	C	Wet	30	2.82	1.41	1.03	.38	.54
11/19	54	8	6	F	Wet	30	3.57	1.78	1.41	.37	.52
		Totals of Colorado plots				495		23.02	8.34	14.68	
		Totals of F plots				405		23.28	13.73	9.55	

1/ Average infiltration rate for last 15 minutes of test

Infiltration rates on the first series of tests on Plots 1 to 6

Plot No.	Infiltration rate in in. per hr. Dry run first test		Wet run second test	
	Colorado	Type-F	Colorado	Type-F
1	3.10		1.77	
2		2.24		1.47
3	2.54		1.86	
4		2.07		1.49
5	2.06		1.94	
6		1.64		1.34
Average	2.57	1.98	1.86	1.43

In the first test the average infiltration rate of the plots under the Colorado applicator was 2.57 in. per hr. for the last 15 min. of the run, and the average infiltration rate of the plots under the type-F applicator was 1.98 in. per hr. The infiltration rate of the Colorado plots then averages 30 percent higher than the type-F plots. In the second tests the average infiltration rate of the Colorado plots was 1.86 in. per hr., and the average infiltration rate of the type-F plots was 1.43 in. per hr. Again the infiltration rate of the Colorado plots averages 30 percent higher than the type-F plots.

The average total intake of the three Colorado plots for the first two tests of 2.5 hr. duration was 6.14 in. while the average total intake for the type-F plots was 4.86 in., that is, the Colorado plots

absorbed 26 percent more water than the type-F plots.

Twelve days later plots 1, 2, 3, and 4 were again run, using the type-F applicator on plots 1 and 3 and the Colorado applicator on 2 and 4. After test two on each of plots 5 and 6 these plots were run under a different plan, to be explained later.

The infiltration results of the latter tests on plots 1, 2, 3, and 4 are shown in the tabulation below:

Infiltration rates on later tests on plots 1 to 4

Plot No.	Final infiltration rate in in. per hr. Dry run third test		Wet run fourth test	
	Colorado	Type-F	Colorado	Type-F
1		1.34		0.62
2	1.39		0.70	
3		1.65		.88
4	1.58		.74	
Average	1.48	1.50	.72	.75

Examination of the average final infiltration rates for the 2.5 hr. of testing shows little difference; however, the average total intake for the two Colorado plots was 4.80 in. and for the two type-F plots 4.05 in., a 19 percent difference. Reference to Fig. 8 will show that the run-off curve for the Colorado applicator levels out much later than that for the type-F but that at the end of the hour the infiltration rate is about the same.

2. After two tests on plot 5 with the Colorado applicator and two tests on plot 6 with the type-F applicator, the applicators were switched back and forth on the plots in order to eliminate the factor of possible plot differences. The fact that the infiltration rate on the plot under the Colorado applicator was consistently higher is illustrated graphically in fig. 5.

The total intake from the plots under the Colorado applicator cannot, because of difference in total time of testing, be compared directly with the total intake of the plots under the type-F applicator. However, the total intake of 10.11 in. in 375 min., averaging 1.62 in. per hr. for the Colorado, indicates an infiltration rate 10 percent greater than the total intake of 8.28 in. in 340 min., averaging 1.46 in. per hr. for the type-F tests.

3. The cultivated plots, 7 and 8, were tested on the same plan as plots 5 and 6, that is, plot 7 received dry and wet applications with the Colorado applicator and plot 8 received dry and wet applications from the type-F applicator. After this the applicators were switched back and forth on the plots.

These plots reacted much in the same manner as did plots 5 and 6. Again, however, because of difference in length of time of application, the total

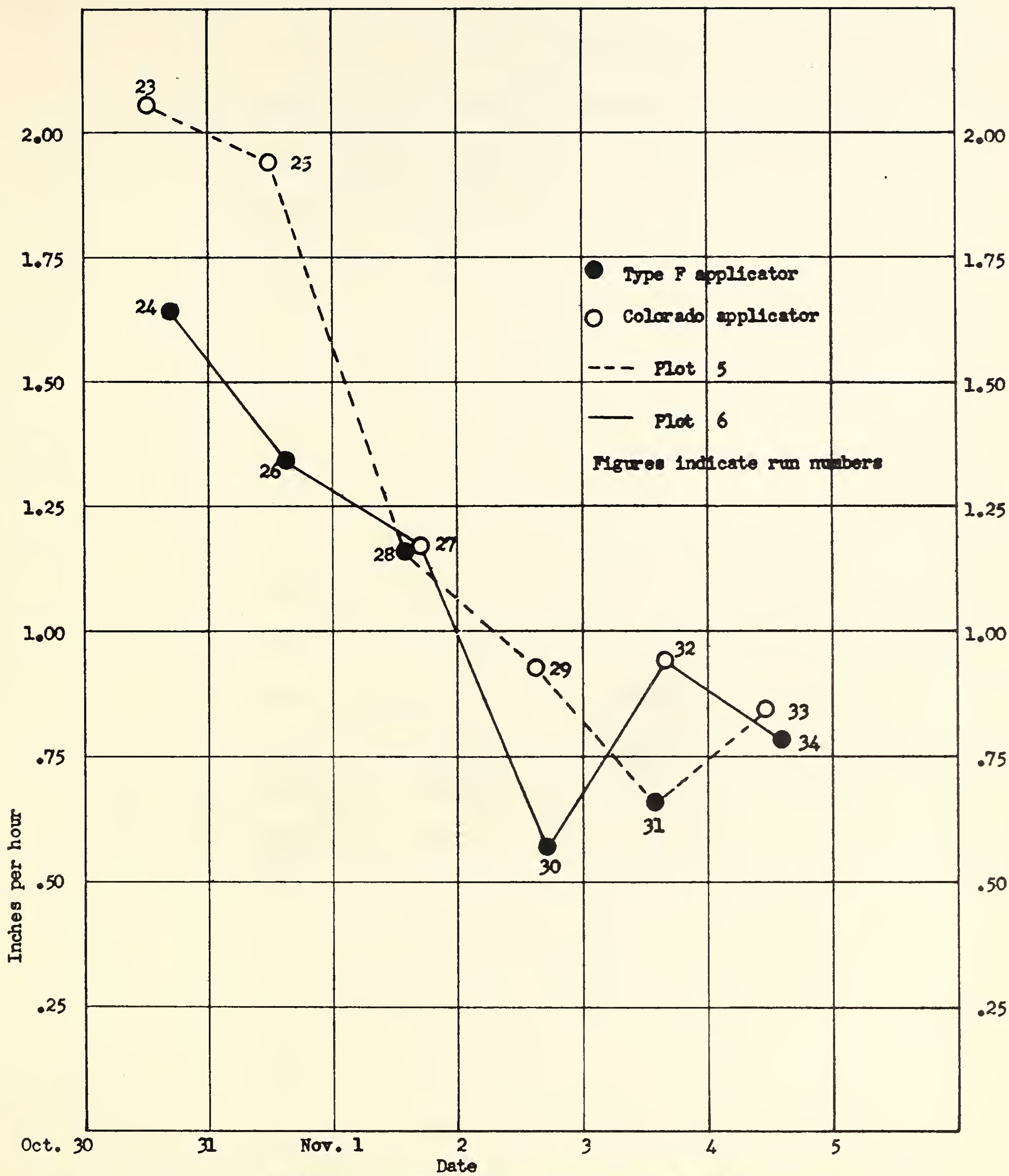

Figure 5. Variation in infiltration rates resulting from changing types of apparatus, grass covered plots No. 5 and 6.

intake on the plots under the two different applicators are not directly comparable and the amount of time difference makes any comparison inaccurate. Because of the long time required to obtain a constant infiltration rate in the first tests on these plots (7 and 8), the tests with the two sprinklers could not be made on the same day. It has been noted in other tests that the time interval between applications has an influence on the infiltration rate and this may account for the seeming discrepancy in runs 45 and 46 in which the infiltration rate on the Colorado plot is lower than on the type-F plot. Fig. 6 illustrates the effects on the infiltration rate of the tests on plots 7 and 8. Examination of the runs 33, 34, 53, and 54 also indicates that with continued wetting the infiltration rates under the different applicators become more nearly equal.

4. Figs. 7 and 8 show the typical graphs of runs with each applicator on similar plots. The long time for leveling off of the run-off hydrograph as shown in fig. 8 is typical of all the tests which were made 10 to 12 days after initial wetting. That is, when the soil was extremely dry a hydrograph as in fig. 7 resulted while when the soil was moist and the plot had

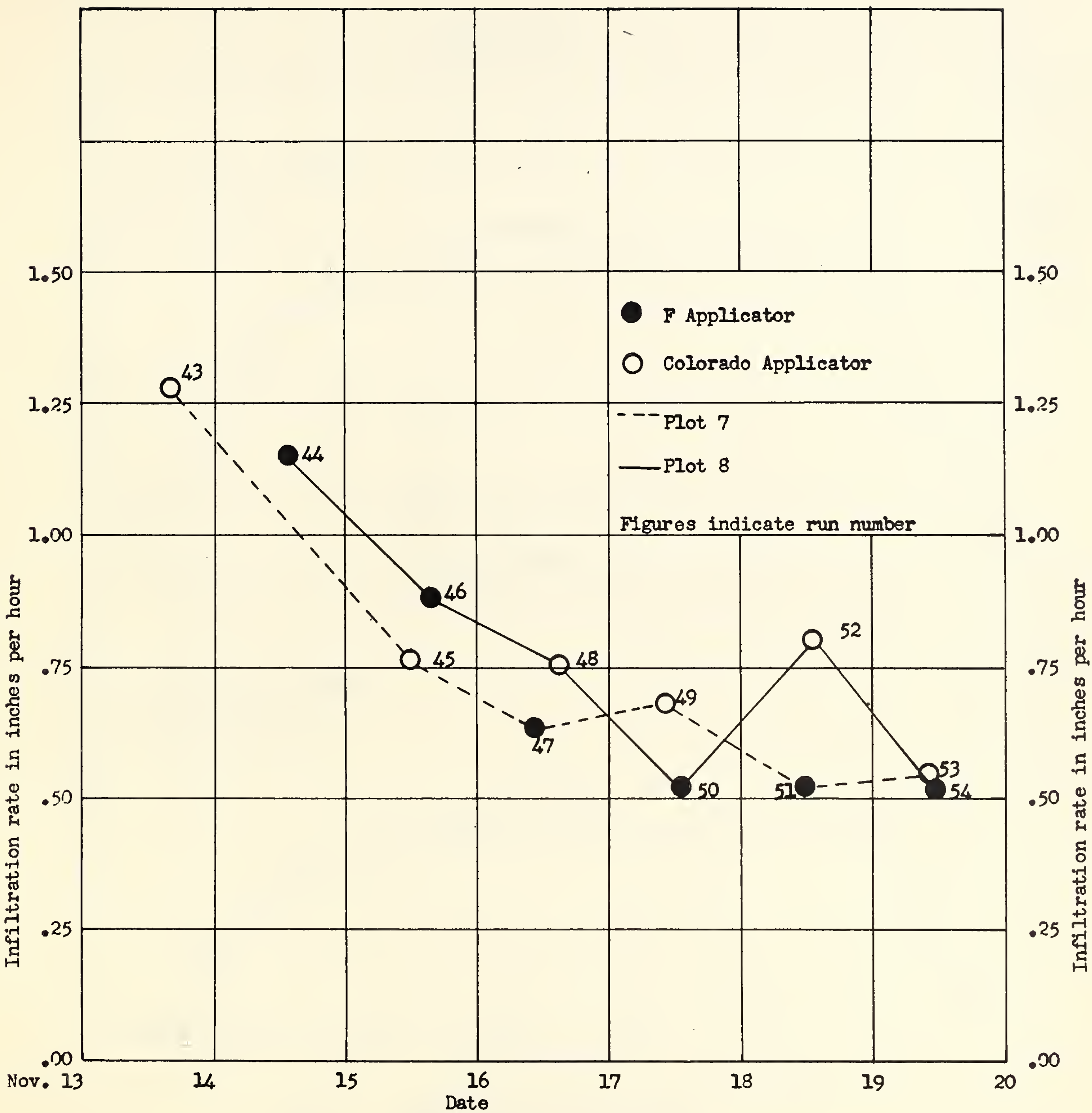

Figure 6. Variation in infiltration rates resulting from changing types of apparatus, cultivated plots No. 7 and 8.

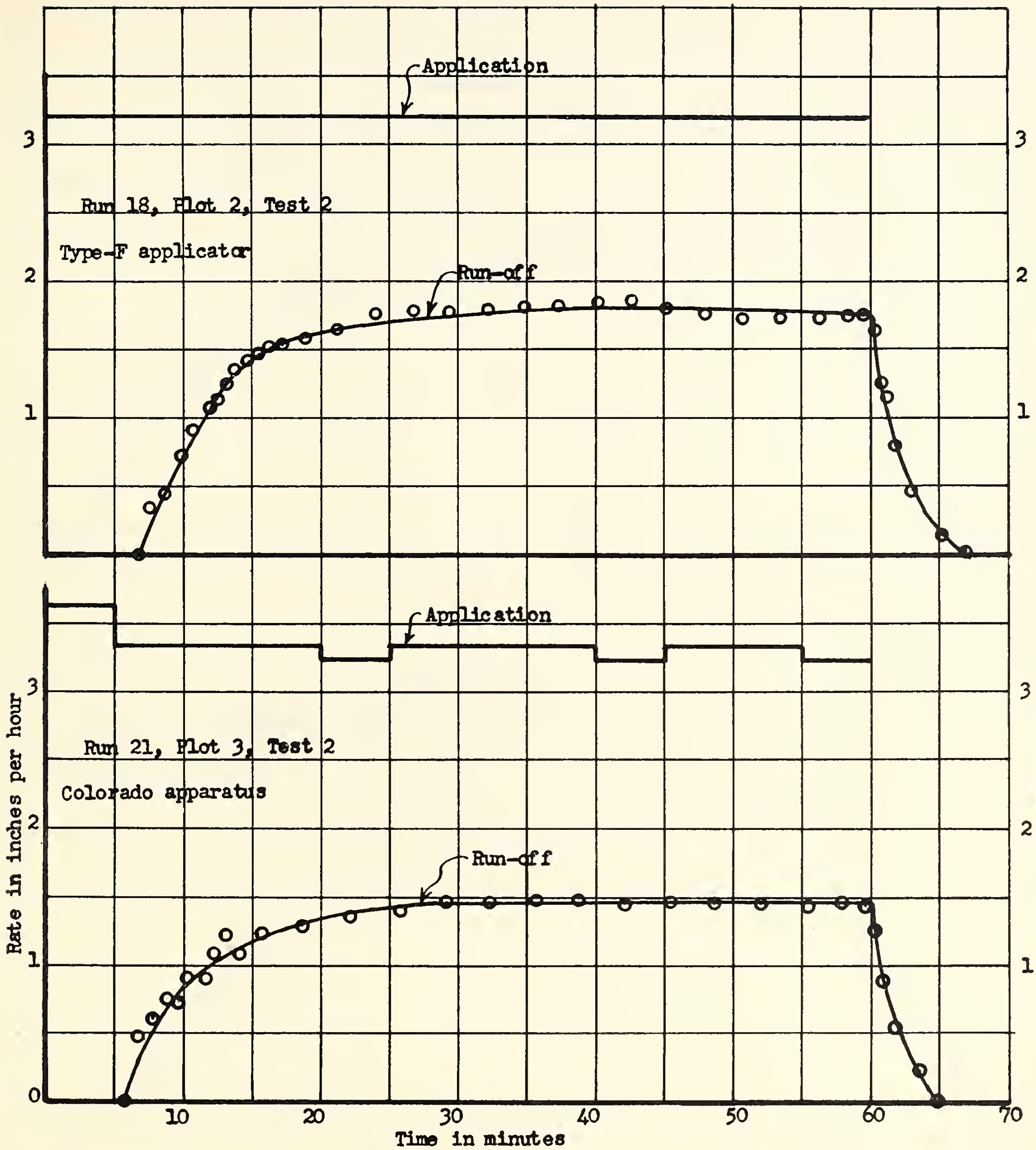

Figure 7. Hydrographs of run-off on similar plots with different applicators

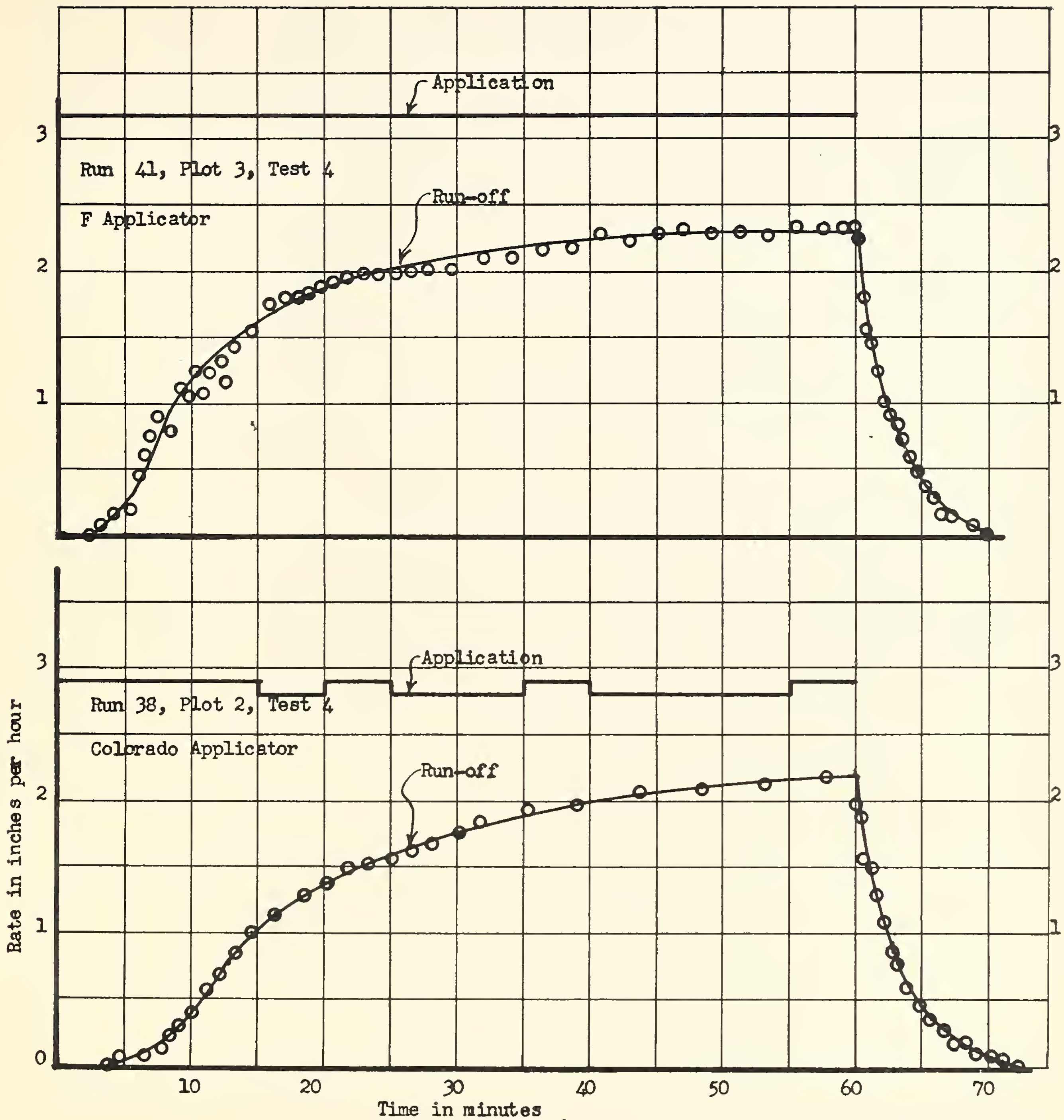

Figure 8. Hydrographs of run-off on similar plots
with different applicators

stood for a week or ten days hydrographs as in fig. 8 resulted.

Also typical of this type test is the longer time for leveling out of the hydrograph of the plot under the Colorado applicator. Curves for several other tests were drawn but no significant differences other than those apparent in figs. 8 and 9 that could be definitely ascribed to the type of sprinkler apparatus were noted.

Summarizing, in the first series of dry and wet runs on plots 1 to 6, the final 15-minute infiltration rate for the Colorado applicator was 30 percent greater than for the type-F applicator, and the total infiltration was 26 percent greater.

In the second series of dry and wet runs on plots 1 to 4, the final 15-minute rates were substantially the same for both applicators but the total water absorbed with the Colorado sprinkler was 19 percent greater than that with the type-F sprinkler.

In the series of alternating tests on the grass-covered plots 5 and 6, the average rate of infiltration for the total duration of the applications was 10 percent greater for the Colorado sprinkler, and in the similar series on cultivated plots 7 and 8, was 27 percent greater.

It is to be expected that tests on other soils with different covers would give different results, but it is probable that there would be differences of degree rather than direction and that the type-F applicator would still indicate lower infiltration rates than the Colorado sprinkler.

DISCUSSION OF DIFFERENCES IN PERFORMANCE

It appears probable that the difference in infiltration rates obtained with the two sprinklers can be attributed principally to the difference in size of drops they produce. Defining the mean drop size as that diameter such that half the volume of "rain" falls in drops of larger size and half in drops of smaller size, measurements made at the National Hydraulic Laboratory by the Hydraulic Section of the Hydrologic Division indicate that the mean diameter of drops from the type-F nozzle, operating under 35 lbs. per sq. in. pressure, is 3.7 mm. whereas the mean for the Colorado sprinkler nozzle at 3 ft. head is 1.6 mm. These drop sizes are not, however, indicative of the relative erosivity of the two sprinklers since the 6 to 7 ft. fall of the larger drops from the type-F nozzle is insufficient to give them their terminal velocity, while the initial velocity impressed on the drops from the Colorado sprinkler nozzles probably brings their velocity at the ground level close to the terminal velocity. The investigations of the Hydraulic Section

indicate that the potential erosivity of the drops from the type-F sprinkler is about twice that of those from the Colorado sprinkler and that the estimated equivalent drop sizes — the size of uniform drops that would give the same erosivity index — are 2.2 mm. and 1.6 mm. respectively. Although other factors modify the net effect of potential erosivity, there is sufficient difference to account for a greater erosion by the type-F sprinkler and the consequent reduction in infiltration caused by the partial clogging of the soil pores.

Duley and Kelly[1] have noted that the impact of the raindrops has a sorting and packing effect on the surface soil and that this results in the formation of a thin compact layer at the immediate surface which at least partially controls the rate of intake. It seems reasonable that the effect of rain impact in the formation of the dense surface layer increases with size of raindrop.

ADVANTAGES AND DISADVANTAGES OF THE DIFFERENT APPLICATORS

1. Convenience and Ease of Operation

The Colorado applicator requires four men to operate efficiently on a series of tests. One man is needed to oscillate

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(1) F. L. Duley and L. L. Kelly. Effect of soil type, slope, and surface conditions on intake of water. Nebr. Agr. Exp. Sta. Res. Bul. 112. 1939.

the header pipe, one to read the water meter, one to keep notes, and one to assist in reading the run-off measuring equipment and for miscellaneous work. The type-F applicator can be operated with three men, one to keep notes, one to attend the motor and pump, and one to assist in measuring the run-off. However, this equipment is a little more difficult to set up and in order to run a number of tests equal to that possible with the Colorado sprinkler four men would be required.

2. <u>Distribution and Intensity of Applications</u>

Field observations indicate that the distribution pattern of the type-F applicator is better. An idea of the pattern can be seen at the beginning of each test on a dry plot. The Colorado pattern consists of a series of paths across the plot. The type-F apparently wets the plot uniformly with the 1.75 in. intensity. It is possible by using different sets of nozzles to obtain a range of intensities of 1 to 5 in. with th Colorado applicator. The nozzles now on hand with the Colorado sprinkler on this project do not produce this full range. The type-F is at present confined to intensities of 1.75$^{\pm}$ and 3.5$^{\pm}$ in. per hr.

The maintenance of a constant intensity with the Colorado equipment is reasonably satisfactory. When a variation occurs in intensity it is shown by the readings of the meter. The maintenance of intensity by the type-F equipment appears equally as good. There is no way, however, of knowing of variations in intensity in

the type-F sprinkler except by the pressure gages and the reflection of the variation in the run-off hydrograph, although the high pressure on the nozzles tends to maintain a uniform intensity. The maintenance of a constant intensity is relatively simple with the Colorado type because of the constant head tank. Forcing the water to the tank by air pressure also eliminates the possibility of trouble by having the motor stop because the pressure built up in the supple tanks is sufficient to operate the sprinkler for 15 or 20 min.

3. Operation on Slopes

In this series of tests there was no slope greater than 6 percent. However, even on these slopes the distribution of the Colorado applicator is affected, whereas no effect of slope on distribution was noted for the type-F. As stated before, the type-F applicator operates on a pressure of 35 lbs. per sq. in. and a difference of several feet in elevation of the two ends of the plot would have little effect on the pressure. The Colorado operates on a pressure of 1 to 2-1/2 ft. of water and a difference of several feet at the ends of the plot causes a decided change in pressure. This is partly compensated for by a valve at the midpoint of the header pipe. The type-F also has the supply pipe along each side divided into two lengths, each controlled by a separate valve.

4. Rain Simulation and Infiltration Rate

As noted above the type-F applicator appeared consistently to have the effect of causing a lower infiltration rate than the Colorado. While there has been, as yet, no definite tie made between a rain simulator and actual rain storms, it is felt that the infiltration rate on a plot operated under the type-F sprinkler may be closer to the actual infiltration rate for the same plot in a natural storm than is the infiltration rate of that plot obtained with the Colorado sprinkler. This statement is based on observations of apparent size of drops, their distribution, and the appearance of the plots during and after tests. Furthermore, some of the water from the Colorado applicator is lost in lateral movement beyond the plot boundaries. This is particularly true during the first runs on a given plot. With the type-F applicator, water is applied in a wide border around the plot. This tends to eliminate lateral movement of water from the plot area.

CONCLUSIONS

1. For the conditions and duration of applications under which the simulated rainfall tests were made the Colorado applicator gave infiltration rates as much as 20 to 30 percent greater than those obtained with the type-F applicator.

2. The type-F applicator more nearly simulates intense natural rainfall than does the Colorado applicator with its finer, oscillating spray.

3. There is no material difference in the operating advantages of the two applicators.

4. The type-F applicator can operate on much steeper land slopes without affecting the uniformity of its intensity and distribution than can the Colorado applicator.

5. The type-F applicator is limited to two intensities, about 3.5 and 1.7 in. per hr., whereas the intensities of the Colorado applicator above about 1/2 in. per hr. are almost unlimited.